CLAIMS

We claim:

MODIFIED CLAIMS

1. An apparatus for the monitoring and control of the combustion process in a combustion system, the apparatus comprising:

   a combustion system comprising a fuel nozzle having a first and second end and an outer shell in fluid communication with the fuel nozzle second end, wherein the outer shell defines a combustion chamber;

   a means for supplying a fuel to the fuel nozzle at a rate;

   a means for supplying an oxidizer to the fuel nozzle at a rate;

   a means for igniting the fuel and oxidizer thereby initiating the combustion process, the products of which comprises hydrocarbon ions;

   a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first

electrode, wherein at least a portion of the combustion process takes place between the first and second electrodes;

a means for applying a voltage between the first and second electrodes; and

a means for determining the magnitude of a current between the first and second electrodes.

2. The apparatus of claim 1, wherein the sensor first electrode is centered in the fuel nozzle adjacent to the second end.

3. The apparatus of claim 1, wherein the second electrode is radially outward of the first electrode.

4. The apparatus of claim 3, wherein the sensor second electrode is part of the outer shell and the outer shell is electrically insulated from the second end of the nozzle.

5. The apparatus for the monitoring and control of the combustion process of claim 1, wherein the nozzle is a lean premix fuel combustion nozzle.

6. The apparatus of claim 1, wherein said first and second electrodes are spaced apart and insulated by a ceramic material.

7. The apparatus of claim 1, wherein said a means for supplying a fuel to the fuel nozzle at a rate that is electronically coupled to said means to determine the magnitude of said current between the first and second electrodes.

8. The apparatus of claim 1 wherein the first and second electrodes are located within the combustion chamber.

9. The apparatus of claim 1 wherein the rate of supply of fuel to the nozzle and the rate of supply of oxidizer to the nozzle is maintained at about a constant level, wherein a decrease in the magnitude of the current indicates the movement of the combustion process away from the first electrode.

10. The apparatus of claim 1, wherein the change in the magnitude of the current is proportional to the change in the amount of hydrocarbon ions in the combustion process.

11. A apparatus for the monitoring and control of the combustion process in a lean premix combustion system, the system comprising:

a lean premix combustion system comprising a fuel nozzle having a first, a second end and a center body surrounded by the nozzle, an outer shell in fluid communication with the nozzle second end, wherein the outer shell defines a combustion chamber;

a means for supplying a fuel to the fuel nozzle at a control rate;

a means for supplying an oxidizer to the combustion nozzle, wherein the amount of oxidizer fuel supplied is slightly greater than the stoiciometric requirement;

a means for igniting the fuel and oxidizer thereby initiating the combustion process;

a sensor positioned within the lean premix combustion system, said sensor including a first electrode and a second electrode in spaced relationship of the first electrode, wherein the sensor first electrode is centered in the nozzle center body and wherein the sensor second electrode is part of the outer shell of the nozzle;

a means for igniting the fuel and oxidizer thereby initiating the combustion process, wherein at least a portion of the combustion process takes place between the first and second electrodes;

a means for applying a voltage between the first and second electrodes; and

a means to determine the magnitude of current between the first and second electrodes.

12. An apparatus for the monitoring and control of the combustion process in a combustion system, the apparatus comprising:

a combustion system comprising a fuel nozzle having a first and second end and an outer shell in fluid communication with the fuel nozzle second end, wherein the outer shell defines a combustion chamber;
a means for supplying a fuel to the fuel nozzle at a rate;
a means for supplying an oxidizer to the fuel nozzle at a rate;
a means for igniting the fuel and oxidizer thereby initiating the combustion process, the products of which comprises hydrocarbon ions;
a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first

electrode, wherein at least a portion of the combustion process takes place between the first and second electrodes;
a means for applying a voltage between the first and second electrodes;
and a means for determining the change in magnitude of a current between the first and second electrodes.

13. The apparatus of claim 12 wherein the change in magnitude of the current between the first and second electrode identifies the presence of a flame.

14. A process for monitoring and control of the combustion process in a lean premix combustion system, the process comprising:

providing a combustion system comprising a fuel nozzle having a fuel inlet, a gas inlet, and an outer shell, wherein at a portion of the outer shell defines a combustion zone and a sensor positioned within the combustion system, said sensor including a first electrode and a second electrode in spaced-apart relationship of the first electrode,

supplying a fuel to the fuel nozzle at a first rate;

supplying an oxidizer to the fuel nozzle at a second rate;

mixing the fuel and the oxidizer;

igniting the fuel-oxidizer mixture such that the combustion process proceeds, wherein at least a portion of the combustion process takes place between the first and second electrodes;

applying a voltage between the first and second electrodes; and

measuring the magnitude of a current between the first and second electrodes.

15. The process of claim 14 wherein the first rate at which the fuel is supplied is adjusted to maintain the magnitude of the current between the first and second electrode at about a constant level.

16. The process of claim 14 wherein the second rate at which the oxidizer is supplied is adjusted to maintain the current between the first and second electrode at about a constant level.